**Planning and Implementation of Demonstrations for the 21st Century Science Classroom**

**VANAS Teacher Conference:** ECA

**Date:** Friday, January 20th

**Session I:** 10:40-11:40

**Introduction:** 10:40-10:45

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**Goal:** To encourage the use of student-centered (and teacher-led) demonstrations in the science classroom as a means of extending learning and experience beyond the typical lab experiment. Also to utilize the technical tools available for the collection of data and proper modeling of processing such data.

**Description:** This presentation will be focused on planning, adapting, discussing, and extending demonstrations in the 21st century science classroom for middle and high school. A proper demonstration should be student led where the class has the opportunity to design, collect and process data, and take chances in a safe environment.

**Why we chose to present this topic:**

This presentation is not about sharing neat demonstrations; it’s about sharing ideas on how to make demonstrations more effective. We decided to cover this topic because we would also like to improve in this area and facilitate a discussion about how we can improve student learning demonstrations.

In each of our schools we are fortunate to have small class sizes, which enable us to engage students on a more concentrated level. An entire class could be taught through a student-led demonstration.

**Lab Demonstration:** 10:45-11:00

**Activity:** Elephants Toothpaste

**Course Background:** HS Chemistry (IB/AP/etc) – Kinetics, Catalysts and Rates of Reaction, Order of Materials in Reaction

**Demo:** In a single 1.0L Graduated Cylinder, 50.0mL 30% H2O2, 25mL 3.0M KI

**Discussion:** The overall reaction of the decomposition of hydrogen peroxide is as follows:

**2H2O2(aq ) → 2H2O(l ) + O2(g)**

As has been discussed in class, the addition of a catalyst lowers the Ea by providing an alternative mechanism to the reaction. The elementary steps for the reaction are theoretical and the intermediates (unless rate determining) do not appear in the overall rate law of the equation.

For H2O2 the mechanism of catalysis using potassium iodide, KI, involves only the I- ion meaning that an aqueous solution of KI will allow for a better reaction. The mechanism involves two steps as follows:

**Step 1: H2O2 + I- 🡪 IO- + H2O** (slow step)

**Step 2: H2O2 + IO- 🡪 I- + H2O + O2**

Second step regenerates the I- ion (confirming that it acts as a catalyst since it returns to its original state).

Since the first step is the slow step, it’s also then the rate-determining step, and alone will make up the rate law.

**Goal:** To determine how the concentration of both the reactant and catalyst effect the rate of reaction

**Planning:** Lead students through the planning of the

**Roles:** Making solutions, running experiment, time, video

**Measurement:** Uncertainty, Graphing, etc

**Complete:** Complete the activity, collect data, process

**Conclude/Discuss:**

**Conclusion:** What can be concluded from this experiment

**Evaluation:** What can be manipulated to improve results and limit uncertainty?

**Extension:** Ask what else we could manipulate (temperature, volume, pressure, etc)

**Discussion of Demonstration Exercise:** 11:00-11:05

Briefly discuss the activity (not the science) with the teachers:

* What aspects of a good demonstration did you see?
* Did you feel engaged? Did you understand the concept? What kind of follow up can be given to support learning?
* What was missing from the demonstration?

**Presentation/Discussion:** 11:05-11:20

A demonstration can be:

* Student-led
* Inquiry-based
* Fun, engaging, and hands-on for all
* A method for completing an activity beyond what individual students would be capable of

A demonstration should not (in most cases):

* Be completed by the teacher alone
* Lack discussion, content, follow up

What does a demo need in order to be successful?

* Planned but flexible
* Predictions should be made
* There should always be follow up

A good time for a demonstration is when students ask \_\_\_\_\_\_\_ and individual labs are not appropriate

* why
* how
* what if I….

When is a demonstration appropriate?

* Prior to introducing new content (inquiry)
* Supporting previously covered content
* Addressing misconceptions
* Applying real-world application
* If materials are too expensive or in limited supply

What can you do to prepare for a demonstration?

* Think about the essential question or end goal of the material to be tested.
* Be aware of the materials available to you. You never know when that teaching moment may appear.
* As you are teaching a specific unit, have materials present that apply to that material

What roles can students play?

* Collecting materials (from other classrooms, lab technician, etc)
* Data Collection of BOTH quantitative and qualitative data (in excel, on the board, etc)
* Data Processing (calculating, graphing, extrapolating, etc)
* Timer
* Safety inspector
* Manipulator (student physically manipulating the materials, mixing chemicals, etc)
* Video/Photos (can be posted to wiki or internet)

What technology can be used to take advantage of being in a 21st century classroom?

* Cell Phones, iPad, iTouch, camera, etc
* Computer
* Vernier Logger Pro / Lab Quest
* Probe ware

**Group Planning of a Demo:** 11:20-11:40

Teachers will be split into groups of their choice and given time to plan an activity together. The focus should necessarily be on the content to be presented but rather on the process of planning a demonstration.

**Biology: ASK JESSICA, Natural selection??**

**Chemistry:** Introducing the concept of the mole, choose another example

**Physics: ASK CHRIS**

**Challenge/Send of:** 11:40

We challenge you to take the time to plan or improve a demonstration and implement it in the classroom sometime in the next two weeks. Be open to student suggestions and make record of how the activity changed compared to what you had anticipated. Make notes for next year and share with your colleagues!